

WE CLAIM:

1. A prophylactic and therapeutic vaccine comprising one or more attachment molecules or fragments ythereof capable of binding to a molecular address on host cell, said binding capable of triggering one or more
5 signal transduction pathways and enabling a selected pathogen and/or its toxin to traffic through host tissue.

2. The vaccine of claim 1, wherein said attachment molecule is a prokaryotic or eukaryotic adhesion molecule selected from the group consisting of proteins, glycoproteins, glycolipids and carbohydrates.

3. The vaccine of claim 1, wherein said host cell is a cell selected from the group consisting of leukocytes, endothelial cells, epithelial cells and cells of the nervous system.

4. A vaccine comprising a microbial attachment molecule which mimics host cell adhesive proteins, glycoproteins, lectins or carbohydrate of host cells selected from the group consisting of leukocytes,
5 endothelial cells, epithelial cells and nervous system cells wherein said attachment molecule binds to ligands on target cells.

5. The vaccine of claim 4, wherein said microbial attachment molecule is a C-type lectin.

6. The vaccine of claim 4, wherein said lectin attachment molecule is a selectin or functional equivalent thereof.

7. The vaccine of claim 4, wherein said selectin molecule is selected from the group consisting of E-, L- and P-selectin.

5 8. A vaccine comprising a microbial attachment molecule which mimics host cell adhesive glycoproteins of host cells selected from the group consisting of leukocytes, endothelial cells, epithelial cells and nervous system cells and wherein said attachment molecule binds to protein or glycoprotein ligands on target cells.

5 9. A vaccine comprising a microbial attachment molecule which mimics the carbohydrate or oligopeptide ligands on cells or the extracellular matrix of cells of tissues and organs wherein said attachment molecule binds to adhesion molecules of host cells.

10. The vaccine of claim 8, wherein said microbial attachment molecule is an integrin or a molecule functionally equivalent to an integrin molecule.

11. The vaccine of claim 10, wherein said integrin molecule is selected from the group consisting of VLA, Leucam and cytoadhesion integrins.

12. The vaccine of claim 10, wherein said integrin molecule is selected from the group consisting of VLA-1,2,3,4,5 and 6, Mac-1, LFA-1 gp150.95, CD41a, CD49 and CD51.

13. The vaccine of claim 8, wherein said microbial attachment molecule is a member of the immunoglobulin superfamily or a molecule which is functionally equivalent to an immunoglobulin superfamily molecule.

14. The vaccine of claim 13, wherein said immunoglobulin superfamily molecule is selected from the group consisting of ICAM-1,2 or 3, VCAM, NCAM and PECAM.

15. The vaccine of claim 4, wherein said microbial attachment molecule binds to a carbohydrate ligand selected from a group consisting of residues of N-acetylneuraminic acid, sialic acid, N-acetylglucosamine, N-acetylgalactosamine, glucosamine, galactosamine, galactose, mannose, fucose and lactose.

16. The vaccine of claim 1, wherein said microbial attachment molecule is a member of the cytokine family and binds to ligands on cells selected from the group consisting of leukocytes, endothelial cells, epithelial cells and nervous system cells.

17. The vaccine of claim 1, wherein said microbial attachment molecule is a member of the chemokine family and binds to ligands on cells selected from the group consisting of leukocytes, endothelial cells, epithelial cells and nervous system cells.

18. The vaccine of claim 1, where said microbial attachment molecule binds to a in cell guanosine triphosphaste (GTP)-binding proteins in eukaryotic cells selected from the group consisting of leukocytes, endothelial cells, epithelial cells and nervous system cells.

19. The vaccine of claim 18, wherein said guanosine triphosphate-binding protein molecule is selected from the group consisting of Rho, Ras, Rac, Cdc42, Rab, Ran and Arf.

20. The vaccine of claim 6, wherein said endothelial cell is selected from the group consisting of cytokine stimulated endothelial cells, and endothelial cells expressing ICAM-1, VAM-1, MAdCAM-1 and PNAd-1.

21. The vaccine of claim 1, wherein the microbe is an intestinal tract microbe selected from the group consisting of *Vibrio cholerae*, uropathogenic *Escherichia coli*, enterohemorrhagic *E. coli*, enteropathogenic *E. coli*, *Salmonella species*, *Shigella species*, *Pseudomonas species*, *Proteus species*, *Klebsiella pneumoniae*, *Aerobacter areogenes*, and *Helicobacter pylori*.

22. The vaccine of claim 1, wherein said microbe is selected from the blood cell group consisting of *Plasmodium berghei*, *Plasmodium falciparum*, *Brucella species*, *Neisseria meningitidis*, *Staphylococcus species*, *Pasteurella pestis*, *Leishmania*, *Trypanosoma* and *Pasteurella tularensis*.

23. The vaccine of claim 1, wherein said microbe is selected from the group consisting of *Mycobacterium tuberculosis*, *Legionella*, *Staphylococcus species*, *Streptococcus species*, *Bordetella pertussis*, *Pasteurella pestis*, *Hemophilus influenzae*, and *Corynebacterium diphtheriae*.

24. The vaccine of claim 1, wherein said microbe is selected from the fungal parasite group consisting of *Blastomyces*, *Aspergillus*, *Cryptococcus*, *Candida*, *Histoplasma*, *Coccidioides* and *Phycomycetes*.

25. The vaccine of claim 1, wherein said microbe is selected from the intestinal parasite group consisting of *Entamoeba histolytica*, *Giardia lamblia*, and *Cryptosporidium*.

26. The vaccine of claim 1, wherein said microbe is selected from the genito-urinary tract group consisting of *Neisseria gonorrhoeae*, *Chlamydia*, *Treponema pallidum*, *Trichomonas vaginales*, and *Tritrichomonas foetus*.

27. The vaccine of claim 3, wherein said microbe is selected from the virus group consisting of Influenza A, Influenza B, Influenza C, Measles virus, Mumps virus, Adenovirus, Rhinovirus, Poliovirus, Hepatitis virus, Hantavirus, Herpesvirus, Rubella, Human Immunodeficiency virus (HIV) and Coxsackieviruses.

28. The vaccine of claim 1, wherein said target host cell is a respiratory cell selected from the group consisting of alveolar macrophages and endothelial and epithelial cells of the nasopharynx and alveoli.

29. The vaccine of claim 9, wherein said vaccine contains peptide domains of the adhesive region on the β -oligomer of an exotoxin selected from a group consisting of *Corynebacterium diphtheriae* exotoxin, *Bordetella pertussis* toxin, *Shigella dysenteriae* (Type 1) toxin, *Salmonella typhimurium* toxin, *Vibrio cholerae* toxin, Enterhemorrhagic *Escherichia coli* verotoxin, Enteropathogenic *Escherichia coli* enterotoxin, *Pseudomonas aeruginosa* exotoxin, *Clostridium tetani* exotoxin and *Clostridium botulinum* exotoxin.

30. The vaccine of claim 4, wherein said vaccine comprises peptide domains of the adhesive lectin region on fimbriae displayed on microbes selected from a group consisting of *Escherichia coli*, *Neisseria gonorrhoeae*, *Neisseria meningitidis*, *Salmonella typhi*, *Salmonella typhimurium*, other *Salmonella* species *Pseudomonas aeruginosa* and *Yersinia enterocolitica*.

31. The vaccine of claim 8, wherein said vaccine comprises peptide domains of glycoprotein adhesion molecules on the cell surface of microbes selected from a group consisting of *Escherichia coli*, *Yersinia enterocolitica*, *Yersinia pseudotuberculosis*, *Helicobacter pylori*, *Vibrio cholera*, *Salmonella typhi*, *Salmonella typhimurium*, *Shigella dysenteriae*, *Leishmania*, *Giardia lamblia*, *Entamoeba histolytica*, *Candida albicans* and *Hafnia alvae*.

32. The vaccine of claim 4, wherein said vaccine comprises peptide domains of glycoprotein adhesion molecules that bind to sialic acid ligands on nervous system cells.

33. The vaccine of claim 31, wherein said vaccine comprises peptide domains of a microbial glycoprotein adhesion molecule selected from a group consisting of *Neisseria meningitidis* and *Escherichia coli* K1.

34. A diagnostic assay comprising a monoclonal antibody specific for a microbial attachment molecule which mimics a host cell adhesion protein, or carbohydrate glycoconjugate of a cell selected from the group consisting of leukocytes, endothelial cells, epithelial cells.

35. A diagnostic assay comprising a peptide or oligopeptide which mimics the adhesive domain of a microbial attachment molecule and reacts with antibodies specific for the adhesive domain of the microbial attachment molecule.

36. A diagnostic assay test kit comprising superparamagnetic beads coated with monoclonal antibodies

specific for a microbial attachment molecule for rapid detection of microbial adhesion molecules in clinical specimens.

5

37. A diagnostic assay test composition comprising a glycolipid matrix displaying host cell carbohydrate ligand molecule of claim 15 and which bind specifically to microbial attachment molecules.

38. A therapeutic composition comprising one or more attachment molecules or fragments thereof capable of blocking the binding of a selected pathogen or its toxin to a molecular address on a host-cell, or preventing further colonization by said selected pathogen, and subsequent pathogen-associated host signal transduction events.

5

39. A therapeutic oligopeptide or glycopeptide of claim 36, wherein said peptide molecule binds to ligands of the selectin family of host adhesion molecules.

40. A therapeutic oligopeptide or glycopeptide of claim 36, wherein said peptide molecule binds to ligands of the immunoglobulin superfamily of host adhesion molecules.

A therapeutic oligopeptide or glycopeptide of claim 36, wherein said peptide molecule binds to ligands of the integrin family of host adhesion molecules.

41. A therapeutic oligopeptide or glycopeptide comprising a molecule which structurally mimics the ligands on host target cells that bind microbial attachment molecules.

42. A therapeutic carbohydrate of claim 15 comprising a molecule which is structurally related to

ligands on host target cells that bind to microbial attachment molecules and used to treat or prevent infectious disease.

43. A therapeututic carbohydrate for the treatment of infectious diseases comprising one or more molecules of claim 15 in soluble form or immobilized in a lipid layer in a live or attenuated cell carrier for use in treating infectious diseases.

44. A therapeutic glycolipid for the treatment or prevention infectious disease comprising molecules of claim 15 which in multivalent matrices binds to microbial attachment molecules.

45. A therapeutic composition comprising one or more attachment molecules or selected fragments thereof capable of blocking the binding of a selected host cell ligand to a molecular address on a selected pathogen, or preventing further colonization by said selected pathogen, and subsequent pathogen-associated, host signal transduction events.

46. The vaccine of claim 1 wherein said delivery system is selected from the group consisting of phage, a live vector, *Salmonella species*, *Shigella species* adenovirus, liposomes, M13 phage, cowpea mosaic virus, alginate gels, peptide conjugates, and glycoconjugates.

47. A vaccine comprising a microbial attachment molecule which mimics a host cell adhesion molecule comprising an attachment molecule selected from the group consisting of proteins, carbohydrates, lipid molecules and conjugates or mixtures thereof.

48. A therapeutic oligopeptide or glycopeptide comprising a molecule which mimics the adhesion molecule of a pathogen and interacts with receptor molecules of a cell selected from the group consisting of leukocytes, endothelial cells, epithelial cells and target cells of the host.

50. A method of obtaining a vaccine for development of immunity to a pathogen comprising the steps of

(a) isolating a pathogen's attachment molecule (PAM) or fragments thereof which mimics a region expressed on host cells and interacts with (blocks) the adhesion molecules of a pathogen;

(b) developing one or more monoclonal antibodies (mAbs) directed against at least one region of the attachment molecule isolated;

(c) isolating epitopes bound by said mAbs to provide a vaccine comprising molecular domains substantially reflecting the topology of a pathogen's attachment molecule.

51. The method of claim 50, wherein said step of isolating is performed by a shear assay using target cells that express the ligand for the adhesion molecule or purified ligands.

52. The method of claim 50, further comprising a said step of analyzing the specificity and blocking properties of mAbs for the pathogen/host target cell interactions by a shear assay.

53. The method of claim 50 wherein said step of isolating epitopes includes a phage display library.

54. A method of obtaining a vaccine for development of immunity to a pathogen comprising the steps of

- 5 (a) isolating a molecule which mimics the adhesion molecule of a pathogen and interacts with receptor molecules of a cell selected from the group consisting of leukocytes, endothelial cells, epithelial cells and other target cells of an animal host; and
- (b) incorporating said molecule into a vaccine.